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# THE FIELD PEA AS A FORAGE CROP

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**T**HE FIELD PEA is widely grown in Canada, and is important in the United States in the northern tier of States and in regions of high altitude farther south in the Rocky Mountains.

The field pea deserves wider use as a winter legume in the Southern States.

Cool weather during the growing season is essential.

The best yields are made on clay-loam soils.

The best early field pea is the French June, the best midseason variety the Golden Vine, and among the most popular late varieties are the Canadian Beauty and the Blue Prussian. Of the newer varieties the Carleton, Kaiser, Bangalia, Paragon, and Gregory are valuable and should be grown more widely.

The field pea should not be cut for hay until the pods are well formed, and for grain it is not well to harvest until the earliest pods are turning yellow.

Pasturing field peas with sheep or hogs has been found profitable in the San Luis Valley of Colorado and is worthy of trial in other pea-growing districts, especially those located near range lands.

When grown for hay, mixtures of field peas with oats or barley are recommended.

Field-pea seed has been used with success as a concentrate in feeding rations for the production of both meat and milk.

Because of its effect on the fertility of the soil, the field pea is valuable in crop rotations, and its use as a substitute for summer fallow in the wheat-growing districts of the Northwest is advised.

Contribution from the Bureau of Plant Industry

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## DESCRIPTION OF THE FIELD PEA.

THE FIELD PEA is an annual plant with slender stems 2 to 4 feet high, which stand erect only where there are other objects to which they can cling. The plants seldom have more than three stalks and very often only one or two. The herbage is pale green with a whitish bloom on the surface. Each leaf bears usually two or three pairs of leaflets and is terminated by a slender, branched tendril. (Fig. 1.) The flowers are reddish purple, pink, or white, mostly two or three to each flower stalk. The hanging pods are about 3 inches long, each containing five to nine nearly round seeds.

The garden pea is cultivated primarily as a green vegetable or as a grain crop for human food; the field pea is grown for hay or for grain to feed to animals. In many cases, however, the same variety is grown for both purposes.

Generally speaking, the varieties with wrinkled yellowish or greenish seeds and white flowers are classed as garden peas, while those with smooth seeds are considered field peas. Some field-pea varieties have yellow seeds and white flowers, while others have colored blossoms and brown, marbled, mottled, or speckled seeds.

Some confusion of name has arisen in this country because in the South the cowpea is often called the field pea, while in the same region the garden pea is distinguished as the English pea. The cowpea is really a bean, resembling the common bean both in its leaves with three large leaflets and no tendrils and in its kidney-shaped seeds. Further, on account of the fact that the true field pea is more largely grown in Canada than in the United States, it is frequently called the "Canada field pea" or the "Canadian field pea."



FIG. 1.—Fruiting branch of a field-pea vine, showing the characteristics of stem and leaf and the succession of bloom and pods.

being grown in Virginia as early as 1636. The cultivation of the field pea did not spread rapidly in that section of the United States, but as the country developed it gained more and more favor in Canada and became a staple crop in the United States only in the New England States, New York, Michigan, Wisconsin, Minnesota, and the eastern Dakotas.

The total area devoted to the field pea in the United States, although considerable, has never been reported in the census; hence, no definite figures are available. The maximum production in central and eastern Canada, to judge from the Ontario reports, was probably reached in 1897, when 896,000 acres of field peas were reported in that Province alone. The acreage in Ontario had decreased to 258,000 in 1909, the decrease being due largely to the attacks of the pea weevil.

This bulletin treats of the field pea as a forage crop, whether grown for hay or for grain for stock, and does not include the cowpea, which, as already stated, is really a bean.

#### HISTORY.

The native home of the pea is supposed to be in that part of western Asia extending from the Mediterranean Sea eastward through Syria and Palestine to the Himalaya Mountains. It appears to have been one of the first cultivated crops, as seeds have been found among the relics of the Stone Age in Switzerland. It was, perhaps, one of the first crops to be brought over by the colonists to the United States, since there are records of its

The cultivation of the field pea throughout western Canada has increased with the settlement of that territory. In Washington, Oregon, Idaho, and western Montana it has also been found well adapted to the climate and soil and is steadily increasing in importance as a farm crop. (Fig. 2.)

#### CLIMATIC AND SOIL ADAPTATIONS.

A cool growing season is essential for the field pea. High temperatures are much more injurious than frosts, which are disastrous to the crop only when they occur just at the period when the pods are setting. These climatic requirements of the field pea limit its successful production as a summer crop to the Northern States and Canada and to high altitudes in the mountains of our Western States. It may, however, be grown with profit as a winter crop in the Southern States. (Fig. 3.) Its moisture requirements are less important than those of temperature, but, other things being equal, it does best where the rainfall is fairly abundant. A 15-inch rainfall in western Canada is sufficient to produce a good crop, while 20 inches of rain in Kansas, Nebraska, or Colorado are inadequate.

Long experience with the field pea has indicated that clay loams of limestone formation are best suited to its culture. As is the case with most other legumes, the field pea thrives best in a calcareous soil. Where the soil is not of limestone formation it is advantageous to add lime frequently. The field pea also does fairly well on sandy loam



FIG. 2.—Field peas in bloom near Pullman, Wash., showing the vigor and uniformity of growth attained in that locality.

soils, but on loose, light sands the growth is usually small and the crop suffers quickly in periods of drought. Heavy, black soils rich in humus tend to produce a heavy growth of vines but comparatively few pods. One may expect a large tonnage of hay on such soils and a small seed yield.

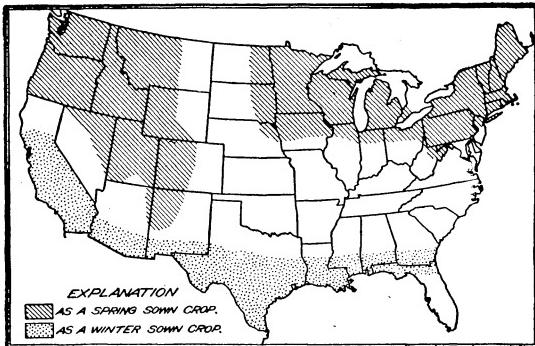


FIG. 3.—Outline map of the United States, showing areas to which the field pea is well adapted.

water occurs or where the soil is habitually soggy. Experiments in Wyoming indicate that soils strong in alkali are disastrous to the crop.

#### VARIETIES.

The variety of field pea grown in any region depends primarily upon its adaptation to soil and climatic conditions and to the object for which the crop is being grown, but local prejudice and the availability of seed peas also affect the choice. The best general-purpose pea and the one most widely known is the Golden Vine. Short descriptions of the principal varieties follow. The seeds of most of them are shown in figure 4.

*Golden Vine.*—The Golden Vine is a medium-early variety having a white blossom and a small, round, cream-colored seed. It has become popular in the United States on account of its uniformly good yields of both forage and seed and the fact that it is usually easy to obtain. The small seeds also make the cost of seeding less.

*French June.*—This is one of the best early varieties. It has white blossoms and is almost identical in seed characters with the Golden Vine, but it matures nearly two weeks earlier and the vine is not so large. In spite of these differences considerable confusion exists in respect to these two varieties, and the Golden Vine is often sold as French June.

*Marrowfat.*—This group of varieties is known to the seed trade under the names Marrowfat, White Marrowfat, and Large White Marrowfat, besides many other more distinctive varietal names, such as Canadian Beauty, Gregory, Arthur, and Potter. The Marrowfat varieties have white blossoms, large, round, cream-colored seeds and large vines. All are rather late in maturing.

*Blackeye Marrowfat.*—This group of varieties has seeds very similar to those of the White Marrowfat except that they have a black hilum, or "eye." As a rule, the peas of this group mature a little earlier than those of the Marrowfat and the vine growth is less. Among the named varieties which belong to this group are the Paragon and the Mackay, two varieties which are among the best yielders in Canada.

*Prussian Blue.*—This is also a well-known variety. It has white blossoms and medium-sized, round, bluish green seed. The vines are large and it is rather late,

Good drainage is essential for success with the field pea. It grows well on moist soils, but will not succeed in locations where standing

maturing about the same time as the Marrowfat. The Prussian Blue is quite popular, as it makes good yields of both hay and seed.

*Wisconsin Blue*.—This variety is very similar to the Prussian Blue in seed characters and also has white blossoms, but it is a little later in maturing. Like the Prussian Blue, it is quite popular in the northern United States. Other rather important

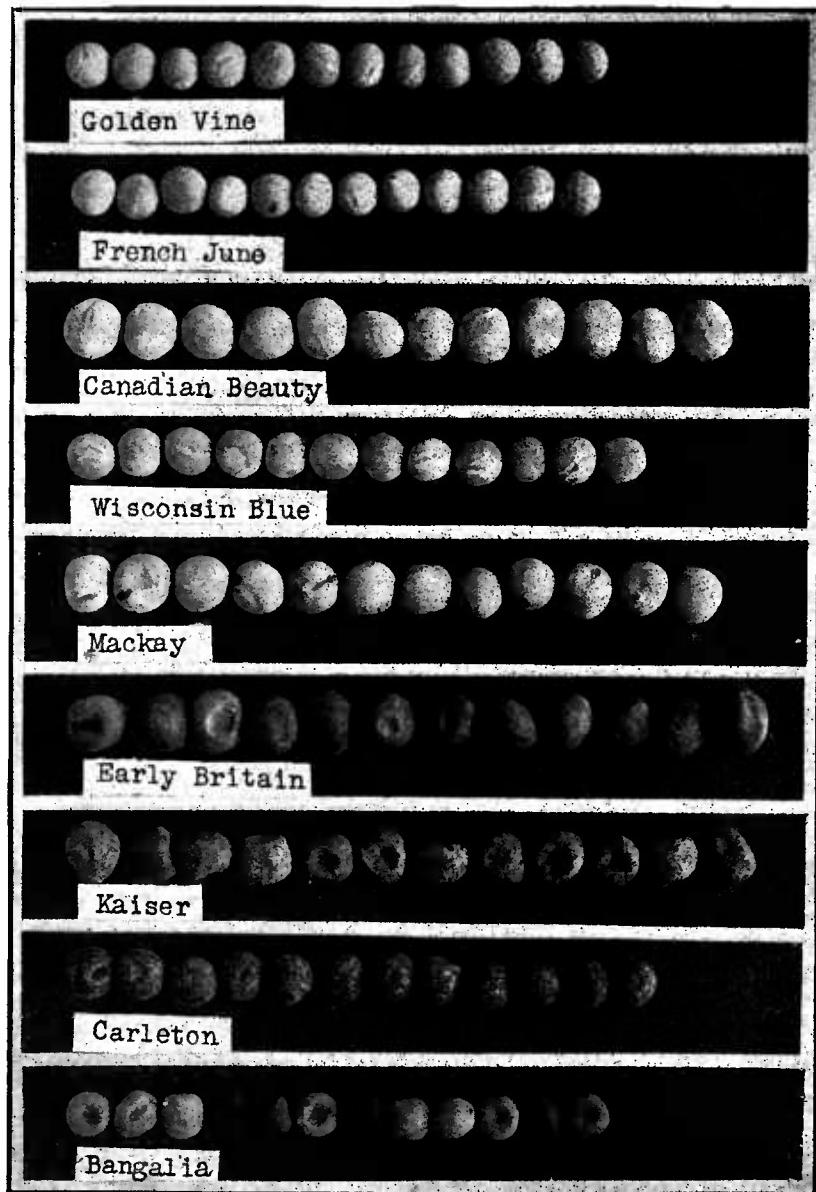


FIG. 4.—Seeds of several important varieties of field peas, showing the most common sizes, shapes, and color markings. (Natural size.)



FIG. 5.—A plat of field peas at the San Antonio (Tex.) Field Station. Photographed in the spring, when about ready to be plowed under.

blue-seeded varieties which may be mentioned are the Scotch, Blue Imperial, and Concordia. The whole group of blue-seeded field peas is grown rather extensively in the Lake region of the United States, where they are utilized both for canning and for stock feed.

*Early Britain*.—The Early Britain is a very distinct variety, having medium to large brown-colored seeds which are dented on the sides, giving them a somewhat wrinkled appearance. It has colored blossoms and a rather stocky vine with large leaves. The Early Britain is about three or four days earlier in maturity than the Golden Vine and is one of the leading varieties in Canada.

*Gray Winter*.—This variety, also called "English Gray," is one of a group of varieties having small, round seeds, gray in color, marbled with brown. The vines are small and the blossoms colored. The Gray Winter is supposed to endure lower temperatures than most field peas.

*Carleton*.—This field pea, which is similar to the Gray Winter, was obtained from New Zealand and has proved to be of special importance in the dry regions of Washington and Oregon.

*Bangalà*.—This variety, secured from India by the United States Department of Agriculture, is fast becoming one of the leading field peas of eastern Washington, northern Idaho, and western Montana, where it has made consistently good yields both with and without irrigation. It resembles the Golden Vine in size of vine, date of maturity, and shape and size of seed. The seeds, however, are greenish in color, turning brown with age. The blossoms are colored.

*Kaiser*.—The Kaiser is a variety introduced from Germany by the United States Department of Agriculture. It has medium to large, deeply dented seeds, gray in color and speckled with purple. The stems also are strongly tinted with dark red. It matures with the Golden Vine or a little earlier and is a good general-purpose pea. A marked peculiarity is its ability to endure high temperatures, which should make it of special importance on the southern edge of the pea-growing district.

#### PREPARATION OF THE SEED BED.

Most growers claim that it is advantageous to fall plow the land for the field pea, on account of the necessity for early seeding. It is usually possible to sow a week earlier when the land has been fall

plowed than if it is plowed in the spring, and the opening up of the soil to the action of the frost during the winter also improves its texture. Spring plowing is satisfactory if it can be done early, and where the seed is to be broadcasted by hand it is easier to cover it properly on freshly turned land than on plowed land which has been allowed to settle during the winter. Where the ground is fall plowed

it is well to work it with a disk as early as possible in the spring and smooth it down after the disk with a drag harrow in case the seed is to be planted with a drill. If one expects to sow the field peas by hand, the ground may be left slightly rough and the seed covered with a disk harrow. Finely pulverized soil is advantageous for the field

FIG. 6.—A mower, showing an attachment designed to raise the pea vines off the ground and allow the passage of the cutter bar beneath them.

pea, but not so necessary for it as for the small grains, since the seed is much larger and the small plant correspondingly stronger.

#### SEEDING.

An important thing to remember is that the field pea must be planted early enough to have time to set its pods before the warm weather of summer arrives. High temperatures are of value to the pea crop only during the ripening period. The young plants are not harmed by light frosts, and even as far north as southern Canada and the northern part of Michigan, Wisconsin, and Minnesota the seed can be planted during the latter part of April and the first of May. In the intermountain sections of Colorado, Wyoming, Montana, and Idaho, from the first to the middle of April is the most favorable time. Throughout the Southern and Pacific Coast States in localities where there is little danger of a hard freeze during the winter, the field pea should be seeded in the fall or early winter. At San Antonio, Tex., the best time for seeding was found to be November 15 to 30. In intermediate latitudes, where hard freezes may be expected during the winter, farmers sometimes sow the peas in February, and in this way give them time to mature in May before injurious hot weather is likely to occur. (Fig. 5.)

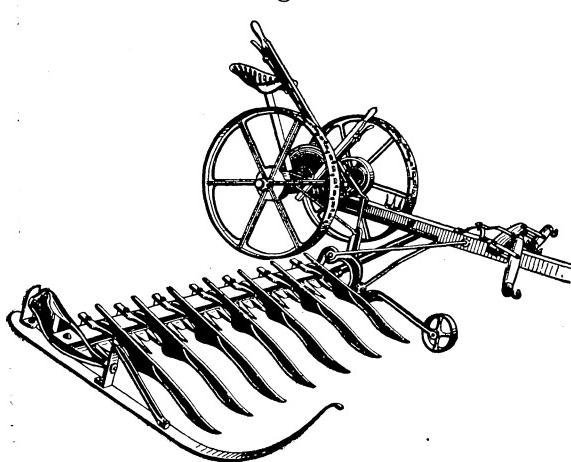




FIG. 7.—A mower with a windrow attachment which automatically removes the material from the swath.

The rate of seeding must be varied according to the size of the seed and the abundance of the rainfall. In the eastern and more humid sections and under irrigation, small-seeded varieties, like the Golden Vine, should be sown at the rate of  $1\frac{1}{2}$  to 2 bushels to the acre; for those with medium-sized seeds, 2 to  $2\frac{1}{2}$  bushels; for the large-seeded varieties, like the Marrowfat, 3 to  $3\frac{1}{2}$  bushels of seed are required. Under more arid conditions, the quantity of seed used should be decreased by about one-half bushel for each group, and when planted in rows 50 to 75 pounds to the acre are enough. For a mixture with oats the relative proportions should be 1 bushel of peas to  $1\frac{1}{2}$  or 2 bushels of oats in the humid regions, but in the dry region the relative amounts of seed should be very nearly reversed. Unless the proportion of oats in the mixture is decreased where the rainfall is light the oats, which start more quickly than the field peas, will prevent any growth of the latter by robbing them of available soil moisture. Mixtures with grain are of doubtful value in regions of light rainfall.

The field pea is best sown with a grain drill, and if either a hoe drill or a disk drill is available it should be used in preference to broadcasting the seed by hand. Peas should be planted from 2 to 4 inches deep, according to soil conditions. In clay loam a depth of 2 inches is best, while in sandy soils a deeper covering is to be preferred. Where a grain drill is not available, peas may be sown broadcast and covered with a disk or drag harrow. Some growers have followed the practice of plowing under the pea seed, but this usually covers it too deep and causes a poor or uneven germination. Care must be used to see that the feed in the drill does not crack the seed. For sowing peas, a drill in which the amount of seed delivered is controlled by the size of the opening in the feed rather than by the



FIG. 8.—Thrashing field peas with an ordinary steam threshing outfit equipped with a self-feeder.

rapidity of its motion is essential. The distribution of the seed, the depth of covering, and the consequent germination are sure to be more uniform where a drill is used. In Ontario the results of 30 experiments throughout the Province gave an average increased yield of  $1\frac{1}{2}$  bushels to the acre for drill-planted fields over those sown broadcast.

Seeding in double rows is practiced to a considerable extent in the drier portions of Washington and Oregon. This is accomplished most successfully by using an ordinary grain drill in which part of the holes or feeds have been closed. Two open holes should alternate with four closed ones, so that each pair of rows will be 30 to 35 inches distant from the next pair, thus allowing room for cultivation. This method is advised especially for new lands by some writers.

#### INOCULATION.

To secure the best results, field peas, like all other legumes, must have upon their roots nodules caused by nitrogen-fixing bacteria. The almost universal use of the pea as a garden vegetable has supplied the soil with the necessary bacteria in nearly all parts of the United States, so that it is seldom necessary to inoculate the soil artificially. In the newly developed farming districts of our Western States, the soil may not contain the necessary bacteria, and in such cases it will be found profitable to provide inoculation. This can be done either through the use of pure cultures, a limited quantity of which can be procured from the United States Department of Agriculture free of charge,<sup>1</sup> or by the use of soil from fields which have previously grown a crop of inoculated peas. Inoculated soil can usually be obtained from gardens where peas have been grown. This soil should be broadcasted at the rate of 250 to 500 pounds per acre

<sup>1</sup> Decided increases in the yield of field peas when inoculated by this method are reported by the Office of Soil-Bacteriology and Plant-Nutrition Investigations of the United States Department of Agriculture for California and a few other States, especially in the new agricultural lands of the West.

when the ground is being prepared for seeding. Care must be used to cover the soil at once after it is scattered, so that the bacteria will not be destroyed by the sunlight. This can be done by following with a harrow immediately after the person who is broadcasting the soil.

Successful inoculation has also been attained by moistening the peas slightly when ready to begin seeding and then sprinkling over

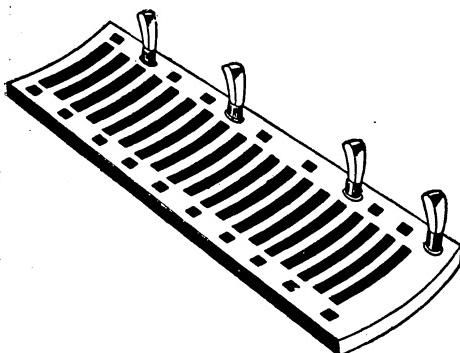
them soil taken from a garden plat where peas have been grown successfully the year before. The seed peas should then be shoveled over thoroughly, so that each pea will have adhering to it some particles of soil. This method is less expensive than scattering inoculated soil over the field and is fairly successful if the peas are seeded soon after treatment without being exposed to the sunlight. A

FIG. 9.—Concave plates with all but four teeth removed, adjusted for thrashing field peas.

variation of this method is to dip the seed peas into muddy water prepared with soil which has grown peas and is known to contain the bacteria.

#### HARVESTING AND THRASHING.

The proper time to cut peas for hay is when most of the pods are well formed, since considerable of the nutrient value of the plant is contained in the seed. When seeded in mixtures with grain, the time of cutting may be governed to some extent by the maturity of the grain, but the varieties of peas and grain used in the mixture should be so chosen that the crop can be harvested at the most favorable period of maturity for both. Formerly, a crop of field peas was considered very difficult to harvest, and much of the harvesting was done with a scythe or an old-fashioned cradle. This was thought necessary, first, because the vines are often tangled and, second, because of the loss from shattering where mower and rake are used. There is now available, however, an attachment for the ordinary mower which consists of guards that extend in front of the cutter bar, lifting the vines off the ground, so that the mower can pass underneath without becoming entangled in the vines themselves. (Fig. 6.) The cost of this attachment is usually from \$12 to \$15. There is also a windrow attachment which effectually removes the peas from the swath and leaves them in a windrow behind the mower. (Fig. 7.) Where such an attachment is not used it is necessary to have a man with a fork follow the mower and move the vines to one side, so that



the team and mower will not pass over the peas in the following round. A mower fitted with the above attachments works well in fields that are smooth and free from stones. The peas can be left in the windrow or bunched with a rake and left until dry and ready to stack. When stacked in the open it is necessary to protect the stacks by means of canvas covers or with a layer of green grass placed over the top.

The field pea should be cut for seed when the pods are fully mature and the peas have become firm. It is not well, however, to wait until the vine and pods are both dry, since if that is done the loss from shattering is sure to be large. Peas are most commonly cut for seed with an ordinary mower equipped with a bunching attachment, but the windrow attachment previously described may also be used with good results. When the bunching attachment is used, a man with a pitchfork follows the mower and moves the bunches out of the path of the horses on the succeeding round. This method leaves the peas in better condition to haul to the thrashing machine or stack than where they are merely windrowed, and it prevents to a large degree the shattering which would accompany any use of a hayrake. In a great many cases the field pea is thrashed directly from the bunch or windrow, as it is very difficult to construct a stack so that it will shed water. If the peas are rained on during the period while they are curing in the windrow or in bunches, they should be turned over as soon as the top of the bunch is dry. If this is not done the peas underneath will swell and burst the pods, so that when they become dry a great percentage will shell out and be left on the ground. Whenever possible, the peas which are intended for thrashing should



FIG. 10.—Treading out field peas with horses and a concrete roller. Few peas are cracked by this method of thrashing.

be stacked under a shed, but if necessary to build the rick outside, it must be protected as noted for hay.

The thrashing of the field pea is usually done with an ordinary grain separator (fig. 8) fitted up especially for the pea by the substitution of blank concaves, leaving only one row of concave teeth below the cylinder. Usually four concave teeth are sufficient to retard the passage of the vines long enough so that the cylinder will break up the pods and release the seeds. (Fig. 9.) By thus limiting the number of concave teeth and reducing the speed of the cylinder about one-half it is possible to thrash the field pea without cracking any considerable percentage of the seeds.

In regions where the field pea is very largely grown, the thrashing machine is commonly equipped with an adjustable pulley wheel made of wood, which can be bolted to the regular cylinder pulley, thus making this pulley large enough to decrease the speed of the cylinder to the required number of revolutions. Where the peas are intended wholly for feeding purposes such precautions are not



FIG. 11.—A machine designed to facilitate the hand picking of peas and beans.

necessary, since cracked seed is then not objectionable. Where the peas are to be sold for seed purposes, however, great care should be used in thrashing, and the peas should be run through a fanning mill after coming from the machine, in order to remove the remainder of the cracked seed. A small pea huller, of which there are several kinds on the market, is well adapted to the uses of a farmer who is growing only a small acreage and expects to sell his thrashed peas to a seed dealer. Where the returns from his pea crop do not warrant the purchase of a machine of this kind and no grain-thrashing outfit is available, the farmer can thrash seed for his own use with a flail or by treading out the peas with horses, as shown in figure 10.

After the peas are flailed or tramped out with horses, considerable work is required to separate the seed from the trash, so that this becomes in the end a rather expensive method of thrashing. A number of seedsmen make a practice of hand picking their better grades of peas, for which grades they charge an advanced price. A simple and inexpensive machine devised to carry the peas on a broad canvas belt slowly before the operator greatly facilitates this process and lessens the labor and cost of picking. The belt is moved by means of a treadle similar to that on a sewing machine. (Fig. 11.)

#### PASTURING FIELD PEAS.

It is a common practice in some localities to harvest the crop by pasturing with hogs or sheep. This is done more largely in the San Luis Valley of Colorado than in any other part of the United States. There is no doubt, however, that the crop can be fully as well utilized this way in other Western States in localities which are near large sheep ranges. When intended for pasture, the field pea is sown alone or with but little grain, as it is not necessary in such cases that it be supported by some more erect growing crop. Animals pasturing on field peas should be confined to one portion of the field by means of movable fences, or else a herder should be employed for this purpose. If sheep or hogs are allowed to roam about over the entire field, they waste a great deal of the crop by wandering around aimlessly as soon as their hunger has been satisfied. The animals should not be turned into the field until the seed becomes hard. Lambs will fatten on field-pea pasture in from 70 to 90 days, and a good crop will usually fatten from 10 to 15 lambs per acre, each animal gaining about 8 pounds a month. Hogs in a thrifty condition will fatten in from 60 to 90 days, and if not obliged to gather their food over too large an acreage will make an average daily gain of 1 pound.<sup>1</sup>

In pasturing hogs or sheep on field peas it is well to remember that good results can not be hoped for unless feed is abundant. The only way to assure continued substantial gains is to move the fattening animals to a new field as soon as peas become scarce and to use stock animals for picking up the scattered peas and for "cleaning up" the field. Hogs especially will not put on flesh rapidly if they are forced to travel about considerably to gather food. Pasturing is a wasteful method of harvesting a crop, even under favorable conditions, and when the weather is bad it not only prevents the animals from feeding properly, thus causing them to lose flesh, but also adds heavily to the direct loss of the crop itself. Many farmers in the San Luis Valley of Colorado are discontinuing the practice of pasturing their field peas on account of this loss and are harvesting

<sup>1</sup> Faville, A. D. Swine feeding. Wyo. Agr. Exp. Sta. Bul. 107, p. 16-21. 1915.

all or a part of their crop and feeding it in a feed lot. A combination of pasture and dry feed has been found best. The animals after a period of pasturing make better gains on dry feed than where given dry feed during the entire feeding period. Alfalfa or sweet-clover pasture used in connection with field peas noticeably increases the rapidity of gain.

#### MIXTURES WITH SMALL GRAINS.

The field pea is often sown in mixtures with small grains, primarily to hold the vines off the ground and thus make the harvesting of the crop easy. Oats are more often used for this purpose than the other grains, although barley is used to some extent and wheat



FIG. 12.—Sheep which have been fed crushed peas and barley in connection with pea silage, near San Acacio, Colo. Note the splendid condition of the ewes. (Photographed by E. H. Thomas.)

in a few cases. The yield is nearly always larger when oats are used than with either barley or wheat. Mixtures are recommended in all cases where the crop is to be used exclusively for hay. The presence of oats or barley in the pea hay makes a better quality of feed than pea hay alone.

Mixtures are occasionally used when the field pea is grown for grain purposes, and in this case the peas and small grain are thrashed out together and the seed separated by means of sieves, either in the thrashing machine itself or in a fanning mill afterwards. It is doubtful, however, whether the greater ease of harvesting is sufficient to overcome the additional trouble required to separate the peas and grain.

## FIELD PEAS AS A GRAIN CROP.

Field-pea seed has been used quite extensively by the farmers of Ontario in feeding farm animals, and beef, mutton, and pork produced with a ration composed partly of field peas is said to have a particularly agreeable flavor.<sup>1</sup> Feeding experiments, however, indicate that the peas used alone as the grain part of a ration are no better than corn, bushel for bushel, in amount of grain produced and are a much more expensive feed.<sup>2</sup>

The field pea is reported also as being very efficient in a ration for milch cows, especially when the peas are mixed with oats.<sup>3</sup> It is doubtful whether a feeder is ever justified in using field-pea seed alone, for several reasons. In the first place, when ground or crushed the meal is heavy and hard to digest, and in addition to this failing it is too high in protein and too low in fat to make its use as a concentrate economical unless it is mixed with other grain feeds strong in fat and carbohydrates. Table I, from Wyoming Agricultural Experiment Station Bulletin 84, illustrates this point.

TABLE I.—*Analysis of the food value of field peas and corn.*

Feed.	Digestible nutrients in 100 pounds.		
	Protein.	Carbo-hydrates.	Fat.
	Per cent.	Per cent.	Per cent.
Peas.....	16.8	51.8	0.7
Corn.....	7.9	66.7	4.3

The proper place for the field pea in feeding operations seems to be in a mixture with oats, barley, corn, or wheat bran, being used as a carrier of protein in the northern feeders' ration much as cottonseed meal is used in the South. (Fig. 12.)

It is always well to grind the peas before feeding, as the seeds of most varieties are very hard, and except when fed to hogs good results can not be expected unless they are ground before being given to the animal. Besides being used in the ordinary feed lot, a great many of the peas, especially in the eastern part of the United States and in southern California, are used by pigeon fanciers in the production of squabs and also by poultrymen as a constituent of their chicken feeds. A small round pea, similar to the Golden Vine, is

<sup>1</sup> Day, G. E. Bacon production. Ontario Agr. Col. and Exp. Farm Bul. 129, p. 15. 1903.

<sup>2</sup> Carlyle, W. L. Feeding ground corn versus ground peas to lambs before and after weaning. In Wis. Agr. Exp. Sta. 16th Ann. Rpt. [1898]/99, p. 44-61, fig. 4-5. 1899.

Day, G. E. Experiments in the feeding of live stock. Ontario Agr. Col. and Exp. Farm Bul. 110, p. 7. 1900.

— Peas vs. corn for fattening steers. In Ontario Agr. Col. and Exp. Farm, 27th Ann. Rpt., 1901, p. 58. 1902.

<sup>3</sup> Murray, James. Experiments with peas. Canada Exp. Farms Rpts., [1908]/09, p. 280-281. 1909.



FIG. 13.—A stack of pea-vine refuse from a canning factory at Geneseo, N. Y. Note the incline up which the load of refuse is hauled to be dumped on the stack.

preferred in such cases. The color of the pea is not a matter of importance in feeding it to pigeons or chickens. In the Lake region, however, where the production of the field pea for stock purposes is combined with the canning industry, the growers prefer a green or white seeded pea, in order that the crop may be available for table use whenever canning factories will pay a higher price for the commodity than will the stockman or grain dealer.

#### FIELD PEAS AS A HAY CROP.

The field pea is commonly grown in Pennsylvania and New York for hay, and the larger part of the crop in the Southern States is also used in this manner. When grown for hay, the field pea is almost always sown in a mixture with oats or some other small grain. As stated before, these mixtures with grain stand up much better, causing less trouble in the harvest, and the presence of oats or barley in the crop also causes it to cure more quickly. The yield from a mixture of oats and peas is usually larger than that from timothy. The field pea works into a rotation very nicely, because of the fact that when harvested for hay it is removed from the field early in the year, thus allowing time for thorough preparation of the soil during the fall. The feeding value of pea hay is quite high, being apparently about the same as that of alfalfa hay. Table II shows the average of all American analyses of field peas and alfalfa, as compiled by Mr. G. L. Bidwell, of the Bureau of Chemistry of the United States Department of Agriculture.

TABLE II.—*Comparative analyses of the dry matter in field pea and alfalfa hay.*

Crop.	Ash.	Protein.	Crude fiber.	Fat.	Nitrogen-free extract.	Number of analyses.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Field pea.....	8.68	19.05	28.14	3.23	39.75	15
Alfalfa.....	8.86	16.35	26.74	3.00	45.05	44

Even the straw from thrashed peas carries a sufficiently high percentage of protein to warrant its careful preservation and use in the feed lot. The digestible nutrients in pea straw compared with those of other well-known roughages, as compiled in Henry's "Feeds and Feeding," are shown in Table III.

TABLE III.—*Digestible nutrients in 100 pounds of air-dry substance.*

Feed.	Protein.	Carbohydrates.	Fat.
	Pounds.	Pounds.	Pounds.
Clover hay.....	6.8	35.8	1.7
Timothy hay.....	2.8	43.4	1.4
Pea straw.....	4.3	32.3	.8
Oat straw.....	1.2	38.6	.8
Barley straw.....	.7	41.2	.6
Corn stover.. . . . .	1.7	32.4	.7

#### FIELD PEAS AS SILAGE.

It is not economical to put the field pea in the silo alone, on account of its high protein content. It makes a better balanced ration and keeps better when combined with some small grain, which should be mixed with the peas in sowing if the crop is intended especially for ensilage. Excellent results from the use of field-pea ensilage are reported from the San Luis Valley of Colorado, and the number of silos in the valley increased from 2 to over 100 in four years. The field peas intended for ensilage usually are planted in mixtures with bald barley and cut when the barley is ripe. This mixture of peas and barley is run through a regular silage cutter and placed in the silo at a cost of \$1 a ton. The yields average from 8 to 12 tons to the acre. Pea ensilage has a higher feeding value than corn ensilage, but should be fed in connection with a



FIG. 14.—Field peas growing in an orange grove at Redlands, Cal. (Photographed February 9, 1909.)



FIG. 15.—A field near Rocky Mount, N. C., showing the production of two crops in one season, the cowpeas following the field peas, which were harvested in May. The large rick in the right foreground is field peas; the smaller ones to the left are cowpeas.

grain ration. (Fig. 12.) For fattening both cattle and sheep it has given excellent results, but is most popular with the dairyman.

One source of pea ensilage is the refuse of pea canneries. This material is not often placed in a regular silo, but is stacked up green as it comes from the cannery and allowed to ferment in the stacks. This means, of course, considerable waste on the surfaces of the stacks, which, coming in contact with the air, always spoils, but 12 or 18 inches under the surface the material will be found packed down closely and in good condition if the stack has been well built. (Fig. 13.) Feeding tests made with pea silage preserved in this way indicate a very high value, especially for dairy cows. It is estimated that about 61 per cent of the total of refuse vines from pea canneries is now made into silage, 21 per cent into hay, 12 per cent is used as green feed, and the other 6 per cent is either used as fertilizer or thrown away.<sup>1</sup>

#### FIELD PEAS AS A GREEN-MANURE AND COVER CROP.

The field pea is well suited for use as a green-manure crop in orchards and is used quite extensively for this purpose in the citrus orchards of California.<sup>2</sup> (Fig. 14.) No other crop except vetch is so well adapted for this use in the southern part of that State. The chief objection to it has always been the expense of the seed. The larger varieties of the field pea require from 3 to  $3\frac{1}{2}$  bushels of seed per acre, the average for all varieties being about  $2\frac{1}{2}$  bushels. The price of seed which has not been hand picked and is therefore apt to be of mixed varieties varies from \$1.50 to \$2 a bushel. This means that the seed alone for a green-manure crop will cost in the neighbor-

<sup>1</sup> For more detailed information on this practice, see Crosby, M. A., Utilization of pea-cannery refuse for forage. U. S. Dept. Agr., Bur. Plant Indus. Circ. 45, 12 p., 3 fig. 1910.

<sup>2</sup> McKee, Roland. Orchard green-manure crops in California. U. S. Dept. Agr., Bur. Plant Indus. Bul. 190, p. 17. 1910.

hood of \$5 an acre. Common vetch, on the other hand, on account of its smaller seed, requires only 60 pounds of seed to the acre and entails an expense of not more than \$2.50 or \$3 an acre. When used for green manure the peas should not be plowed under until they have reached their maximum growth, unless other conditions connected with the main crop require that the plowing be done earlier. It is well to remember that the field pea continues to grow long after the first blooms appear, successive blooms being formed as the stem elongates. The most favorable time to plow the peas under will probably be reached, therefore, about the time the first pods are well filled.

The varieties selected for use as a green-manure or a cover crop should be those which are known to be adapted to the locality, and one with a good-sized vine is to be preferred over those that make a heavy yield of seed. The large Marrowfat peas, such as the Canadian Beauty, Arthur, Paragon, and Mackay, are well adapted for this purpose, as are also the Prussian Blue and Wisconsin Blue.

The use of a green-manure crop is profitable only in sections where sufficient soil moisture is present to cause the quick decay of the vegetable matter turned under. This prerequisite is supplied in southern California and other irrigated districts by the irrigation water. The immediate financial loss accompanying the use of green-manure crops in rotation systems which are being tested in the Great Plains region is due largely to the insufficiency of soil moisture and the fact that the green-manure crop often occupies the ground late in the season, using up the supply of moisture which would otherwise be available for the next crop.<sup>1</sup>

#### VALUE OF FIELD PEAS IN ROTATIONS.

The value of the field pea in rotations with hay, grain, and corn crops has been proved throughout the Northern States and also in a few localities in the mountain districts and irrigated valleys of the West. In the Northeastern and North-Central States, where rotations are regularly practiced, the field pea usually follows a meadow crop. This would seem to be the wrong place for it in a rotation, because of the fact that nitrogen and humus are usually fairly abundant in the soil after a meadow has been plowed up. In practice, however, it is found that the crop of field peas is very effective in furthering the disintegration of the sod left by the grass. It is this fact which has determined its position in the rotation. The ground is left in especially good condition for a wheat crop, and the increase in yield of grain due to a preceding crop of field peas has been quite

<sup>1</sup> Chileott, E. C. Study of cultivation methods and crop rotations for the Great Plains area. U. S. Dept. Agr., Bur. Plant Indus. Bul. 187, p. 55, 70. 1910.

marked. The effect of the nitrogen added by a well-inoculated crop of field peas is shown by a decided increase in the amount of straw accompanying the larger grain yield of the following crop. This is well illustrated by the results at the Montana Experiment Station in 1903,<sup>1</sup> as shown in Table IV.

TABLE IV.—*Yields of oats following six crops, showing the beneficial effect of field peas.*

Crop on land in 1902.	Yield of oats in 1903.	
	Grain.	Straw.
Field peas.....	Bushels.	Pounds.
Wheat.....	106	- 3,410
Clover.....	49	1,250
Barley.....	86	2,665
Sugar beets.....	42	1,115
Oats.....	82	2,400
	64	1,448

The substitution of a crop of field peas for summer fallow in the wheat rotations of the Northwestern States is being advocated by agriculturists. It has been found that a crop of peas will leave the ground in practically as good condition for wheat as will fallow, and the yield of the succeeding crop usually is as good and in some cases better. Troubles from smut in the wheat also are less noticeable where wheat follows field peas. At the Sherman County Branch Experiment Station, Moro, Oreg., the average yield of four plats of spring wheat after field peas for four years was 40.2 bushels an acre, while the average yield of two adjacent plats of wheat after summer fallow during the same period was 38.5 bushels to the acre.<sup>2</sup>

The use of the field pea as a winter legume in the South permits the production of two crops on the land during one season. In some localities, as at San Antonio, Tex., the peas are sown in the fall, usually the latter part of November. Some injury has resulted from winter freezes, but a few varieties have been found which will survive, and these have produced about 2 tons per acre of hay, or 14 bushels of thrashed peas when allowed to mature. They are much more profitable in this way than cowpeas planted as a summer crop following a small grain or corn.<sup>3</sup>

In North Carolina it has been found possible to plant field peas in February, harvest them in May, and then grow a crop of cowpeas, sorghum, or millet on the same field. Such a crop system is illustrated in figure 15.

<sup>1</sup>Atkinson, Alfred. Canadian field peas. Mont. Agr. Exp. Sta. Bul. 68, p. 86. 1907.

<sup>2</sup>Stephens, D. E., and Hill, C. E. Dry-farming investigations at the Sherman County Branch Experiment Station. Oreg. Agr. Exp. Sta. Bul. 144, p. 24. 1917.

<sup>3</sup>Hastings, S. H. Work of the San Antonio Experiment Farm in 1914. U. S. Dept. Agr., Bur. Plant Indus., West. Irrig. Agr. [Circ.] 5, 16 p., 6 fig. 1915.

## DISEASES AND INSECT ENEMIES OF THE FIELD PEA.

**Powdery mildew.**—Powdery mildew<sup>1</sup> is usually most destructive on late-planted or late-maturing varieties of field peas. It is also confined rather closely to humid climates, where it sometimes reduces the yield considerably. The remedy lies for the most part in the rotation of crops, but where only small portions of a field are affected the disease can be controlled by spraying with Bordeaux mixture. If large areas are affected it is not economical to spray.

**Leaf-spot or pea-blight.**<sup>2</sup>—Another disease which has been troublesome in the pea-canning districts of both Wisconsin and Ohio<sup>3</sup> is the leaf-spot or pea-blight. This disease can be controlled in the same way as powdery mildew by spraying with Bordeaux mixture where the area affected is small, but in large fields the farmer must depend upon the rotation of crops. Although the disease is carried on the seeds, treatment of the seed with insecticides or hot water is not effective, because the germ of the seed is injured by the treatment more quickly than are the spores of the fungus.

**Pea weevil.**—The pea weevil<sup>4</sup> is the most serious insect enemy of the field pea,<sup>5</sup> and it has done more than anything else to limit the acreage devoted to this crop in Canada. According to Prof. C. A. Zavitz, in Bulletin 126 of the Ontario Agricultural College, the acreage of field peas in Ontario in 1902 was just about half what it would have been if the weevil had not proved so destructive. There was a steady increase in area from 560,770 acres in 1882 to 896,735 acres in 1897, but from this time there was a gradual decrease to 532,639 acres in 1902. A constant increase in the weevils during this period is shown by the percentage of weevily peas in the Early Britain variety grown at the Guelph Experiment Station.<sup>6</sup> These percentages were as follows: 1894, 2 per cent; 1895, 7 per cent; 1896, 11 per cent; 1897, 34 per cent; 1898, 49 per cent; 1900, 75 per cent; 1901, 96 per cent. After 1901 there was a decrease in the percentage, probably due to the fact that many of the farmers around Guelph quit growing the field pea. The reduction of acreage in the Province continued, however, the average for the five years ended in 1923 being only 113,072 acres.

The pea weevil is a small grayish or brownish gray beetle, marked with lighter spots. The insect lays its egg on the young pod and this egg hatches out and produces a larva which bores through the wall of the pod and enters the young pea, where it feeds on the growing embryo and later pupates. The pupa remains in the seed until the next season, usually emerging from the pea the following spring, but the behavior of the weevils is unfortunately not uniform in this respect, many of them coming out sooner, so that the dates of emergence will range from harvest to planting time the following year. One remedy for the attacks of the weevil is to store the seed intended for planting in tight bags and hold it over for one year, in which case the beetle will emerge from the seed and die before the next

<sup>1</sup> *Erysiphe polygoni* DC.

<sup>2</sup> *A seochyta pisi* Lib.

<sup>3</sup> Van Hook, J. M. Blighting of field and garden peas, chiefly due to seed infection.—Powdery mildew of the pea. Ohio Agr. Exp. Sta. Bul. 173, p. 231-249, 12 fig. 1906.

Russell, H. L. Pea blight. In Wis. Agr. Exp. Sta. Bul. 228, p. 4-6, fig. 1. 1913.

<sup>4</sup> *Laria pisorum* L.

<sup>5</sup> Chittenden, F. H. Insects injurious to beans and peas. In U. S. Dept. Agr. Yearbook for 1898, p. 233-260, fig. 66-82. 1898.

<sup>6</sup> Zavitz, C. A. The results of field experiments with farm crops, 1904. Ontario Agr. Col. and Exp. Farm Bul. 140, p. 25. 1905.

planting season arrives. Another method employed by seedsmen is to fumigate the seed with carbon bisulphid, which can be obtained at a reasonable cost from any druggist. In applying this remedy the seed must be placed in a tight box or barrel and exposed from 30 to 48 hours to the fumes of this liquid. The carbon bisulphid should be exposed in a shallow dish placed on top of the peas, since the vapor is heavier than air. This vapor when mixed with air is quite inflammable, and care should be taken not to ignite it in any way; otherwise, a serious explosion may occur. One pound of the liquid is usually considered sufficient to fumigate 100 bushels of peas, but it is well to use somewhat more than this in order to be sure of killing all the insects.

Continuous cropping of the land to the field pea is almost sure to mean a constant increase in the numbers of the pea weevil. Practically the only remedy for this state of affairs is to stop growing peas for several years, in which case the weevil will be exterminated through lack of food.

Attempts have been made to discover a substitute for the field pea which is not subject to the attacks of this insect. Among the legumes which have been tried for this purpose are the grass pea and the chick-pea. The weevil does not injure either of these peas, but they are not productive enough to make a profitable crop for the ordinary farmer, and the market for the seed is not sufficiently well established to guarantee him a dependable price.

**Pea aphis.**—Another insect which occasionally does considerable damage is the pea aphis, or plant louse.<sup>1</sup> It has appeared in pea-growing sections at intervals and practically destroyed the season's crop, but it does not stay with the crop so continuously year after year as does the weevil. The aphis increases rapidly during a period of warm, dry weather, but a heavy rain, even when the insect is abundant, will sometimes free the vines almost entirely from it. Unless some weather condition acts in this way to destroy the pest, the only hope of the farmer is for the parasites of the aphis to increase sufficiently in numbers to overcome and destroy it.

**Pea moth.**—This insect<sup>2</sup> has lately become troublesome in the pea-growing district of northeastern Wisconsin and is found occasionally also in Michigan.<sup>3</sup> The moth appears soon after the pea vines begin to bloom, usually about July 14, and lays its eggs on the pods, leaves, and stems. The egg hatches in 7 to 10 days and the larva enters the pod and feeds on the seeds. Growth is completed in from 16 to 26 days, and the larva then emerges from the pod and passes the winter in the soil.

In the worst infested parts of Wisconsin 10 to 50 per cent of the pods were found to be attacked by the worms. Seed of such pods is practically useless for soup and much less desirable than clean peas for feeding to livestock.

The most effective remedy is to grow early varieties, seed as early as possible, thrash early, and then burn the rubbish left on the field.

<sup>1</sup> *Macrosiphum pisi* Kalt.

<sup>2</sup> *Laspeyresia nigricana* Steph.

<sup>3</sup> Fluke, C. L., Jr. The pea moth: How to control it. Wis. Agr. Exp. Sta. Bul. 130, p. 12. 1920.